A Study of Margin Requirements effecting Volatility

A Senior Honors Thesis

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Dedications

I dedicate this paper to my family, without their support I would not have been able to accomplish my goals. Thank you all for always being there for me.

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I.

After the stock market crash of 1929, Congress established the Securities Exchange Act of 1934. The Securities Exchange Act of 1934 allowed the Federal Reserve Board (FRB) the authority to set initial, maintenance, and short sale requirements on all securities traded on a national exchange. The purpose was to regulate the securities credit extended by exchange members. The FRB also established Regulation T (Reg T), the rules governing the percentage of equity value a broker/dealer was allowed to lend on exchange-traded securities. The securities markets had a long history of federal margin regulation, but in 1992 the U.S. Congress had extended the FRB's margin-setting authority to include the levels for future products.

The maximum loan value of a security is determined by the initial margin requirements. If the original margin requirement was set at 40%, an investor could post collateral and borrow up to 60% of the securities value. Alternatively, if the investor were to buy the security on margin, the investor would be required to deposit at least 40% of the value of the security in a margin account to finish the margin transaction.

Margin requirements in equity derivative markets are collateral requirements designed to ensure contract performance. From an economic standpoint, there is no extension of credit in equity derivative markets. Despite differences in their form and function, the margin requirements on equity derivatives contracts affect the cost of taking positions and naturally define the maximum amount of return leverage that can be achieved in such contracts.

The 1934 U.S. Congress conceived federal margin authority with three apparent objectives: to protect investors from over lagging, to reduce the use of excessive credit in securities transactions, and to reduce the volatility of stock prices. The Congress apparently believed that a federal margin policy could be used to regulate the amount of credit allocated to unproductive investment in the stock market and thereby decreases the effects of destabilizing speculation on stock prices. The dominant view in Congress held that a fixed pool of credit was available to support investment activities, and any credit used to purchase stocks was unavailable to finance helpful investments in plant and equipment. Further, it was widely believed that stock-related credit defended the activities of speculators, whose trading activities supposedly created unnecessary volatility in the stock market.

The U.S. Congress may still hold the view that margin requirements can be effective as a selective credit control. As federal margin authority has yet to be repealed, these margins can be useful as a tool for stabilizing stock prices. According to Jegadeesh, " The majority of the finance profession appears to have abandoned the beliefs that underlie the original margin authority mandate. Few believe that selected credit controls, inappropriate as rules for investor protection, are unlikely to be useful in controlling stock price volatility."[1]

Before to the 1987 stock market crash, little evidence suggested that margin policy was effective in achieving the goals behind the 1934 authorization. " By the early 1980's, the academic research on margin policy had shifted focus from evaluating the

[1] Gordon, G. "Security Baskets and Index Linked Securities," *Journal of Business* 66, no. 1 (1993), 1-28.

effects of changes in Reg T margins to analyzing the procedures appropriate for setting prudent margins in future markets," from research from Hardouvelis.[2]

The 1987 stock market crash and the studies that followed resurfaced interest in margin policy and started a political and academic debate on efficacy of margin policy for common stocks and their derivative products said Jegadeesh.[3] While a vast number of the stock market crash studies discussed margin policy in the context of market integrity, these studies reached considerably different conclusions.

The New York Stock exchanges report on the crash, The Katzenbach Report, contradicts the conclusions of FRB's 1984 margin study, and it provides no proof to defend this difference of opinion. After instituting its position on margin efficiency, the report then observes that the low margins and trading costs associated with the stock index futures products encourages speculation that ultimately leads to greater volatility in cash markets. The Katzenbach Report recommends raising margin requirements on stock index futures contracts and modifying futures settlement procedures to replace the leverage advantage enjoyed by stock index futures products.

The Securities and Exchange Commission's report, " The October 1987 Market Break" (1988), largely agrees with the recommendations of the Katzenbach report. In comparison to the aforementioned studies, neither the Brady Commission report nor the report of the President's Working Group on Financial Markets, clearly calls for raising derivative product margin

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[2] Hardouvelis, Gikas, "Margin Requirements and Stock Market Volatility," *FRBNY* Quarterly Review (Summer 1988).

[3] Jegadeesh, Narasimhan, "Liquidity Effects on the Introduction of the S&P 500 Index Futures Contract on Underlying Stocks," Journal of Business 66, no.2 (1993), 171-187.

requirements. The Brady Commission Report (1988), " Report of the Presidential Task Force on Market Mechanisms," concludes " Margins should be made consistent across marketplaces to control speculation and financial leverage." Even though the Brady Commission seems to embrace the hypothesis that volatility and leverage are related, it did not suggest increasing margins on equity derivative products to correspond with 50% initial margin required on stock transactions. Regardless of recommending equalizing leverage, the Brady Commission was reluctant to suggest the appropriate level at which leverage should be balanced.

Suggestions that margin requirements should be set to correspond with the leverage in stock and stock derivative contracts, led some to advise that regulatory changes that would confide stock and stock derivative margin-setting policy to a single regulator. Eventually, these suggestions led the U.S. Congress to allow the FRB margin-setting authority over stock index futures contracts to the CFTC in 1993. The margin policy disagreement, apparent in the official reports that analyzed the 1987 crash, produced renewed academic interest in margin policy research said Grube. A powerful study by Hardouvelis (1988) came to the conclusion that historical evidence maintained the proposal that margin requirements could be used to control the stock market volatility. The conclusions by Hardouvelis study were questioned by many other studies, and the margin volatility literature expanded significantly. The empirical literature that followed the Hardouvelis study supports pre-cash academic view. Nevertheless, little direct empirical evidence provides the proposition that margin policy can be an effective tool in controlling stock market volatility. In spite of the predominate academic finding, some still take the view that margin requirements operate as the 1934 Congress

anticipated. Margin policy advocates defending their position by remarking that the insufficiency of strong direct econometric evidence can be easily enlarged. They claim that the true underlying market volatility relationship may be econometrically disguised by the infrequency with which margins have been changed, the substantial noise component in stock price and stock return data, and the inappropriate measurement techniques used in most margin volatility studies.[4]

The conditional relationship between margin requirements and volatility is driven by leverage. While there certainly is a positive relationship between leverage and the return volatility of an individual investor's portfolio, the margin-volatility controversy considers the assertion that the return volatility of unleveraged equity portfolios is decided at least in part by the amount of leverage preferred by individual investors. An essential circumstance for the existence of a negative margin volatility relationship is that, on average, there must be a positive association between the degree of leverage in individual investor portfolios and the volatility in the underlying market. Of course, the margin recommendations of the three of the major post crash studies are assumed on the hypothesis that leverage enables speculators to produce unnecessary volatility.

Considering the results of studies that measure the effects of derivative market introductions, this study concludes that no substantial body of evidence supports the hypothesis that margin requirements can be systematically retailored to control volatility in stock markets. The empirical evidence displays that, although Reg T margin requirements may decrease the volume of securities credit lending, and high futures margins do seem to be systematically correlated with lower stock return volatility. This

[4] Grube, R.C., "Market Responses to Federal Reserve Changes in the Initial Margin Requirement," *Journal of Finance* 34, no.3 (1979), 659-674.

evidence indicates little or no empirical evidence supports the hypothesis that tightening leverage constrains in either the cash or equity derivative markets will reduce stock return volatility.

II.

The idea held behind the 1934 U.S Congress and those who continue to believe that high margin requirements continue volatility is that low initial margins enable speculators to exert undue influence in stock markets and therefore create excess volatility. It is alleged that speculators drive stock prices beyond their fundamental values through a process known as pyramiding. Pyramiding pertains to the dynamic in which gains in stock prices allow over confident agents to obtain additional funds for further equity purchases. When the unavoidable market correction begins, leveraged investors faced with margin calls are required to liquidate positions. The "depyramiding" process supposedly causes bypassing of the fundamental equilibrium. As a result, low margin requirements cause an additional source of volatility over the volatility attributable to fundamental economic forces.

Despite the insightful appeal of this pyramiding-depyramiding explanation, it is at best failing to be complete. It distinguishes only one feasible avenue through which margin requirements may influence volatility. Goldberg developed a theoretical model that implies a positive relationship between margin requirements and stock price volatility. In Goldberg's model, when investors are pressured by margin requirements, they bid up the prices of more highly leveraged firms and thereby encourage enhanced corporate leverage. In the consequent general equilibrium, corporate leverage is exchanged for private leverage and stock price volatility expands in response to increased corporate leverage.

Kupiec and Sharpe formed an equilibrium model in which irrational speculators may cause excess stock price volatility. In contrast to pyramiding-depyramiding

hypothesis, this model implies the possibility of a positive relationship between margin requirements and excess stock market volatility. The model illustrates that high margin requirements may lower the equity purchases of liquidity-constrained rational investors when a shift in irrational trader demands creates a decline in equity prices. Because those who are willing to bear risk are confined from borrowing to purchase additional shares, equity prices descend below their fundamental values. Therefore, higher margin requirements produce greater equity price volatility. Relying on the characteristics of investors in the model, consistent with the pyramiding-depyramiding hypothesis, it also is feasible for margins to reduce volatility in the Kupiec-Sharpe model by limiting the leverage of irrationally optimistic agents. Given the possibility of these two contrasting cases, the Kupiec-Sharpe model proves that there is no unique theoretical relationship between margin requirements and asset price volatility; from a theoretical point of view it is equally probable that low margin requirements may decrease stock price volatility as increase it. Surely, overtime the effects of margin requirements may change as the sources of excess stock price volatility change over time.

III.

Before the late 1980's, essentially all published academic information implied that changes in the Reg T margin requirements had no statistically calculable effect on stock price volatility, when volatility was measured by the standard deviation of the returns on a broad stock market index according to Kupiec.

The 1988 study by Hardouvelis questioned Moore's discoveries and the results of earlier academic findings and came to the conclusion that, over the 1934-1987 period, monthly stock return volatility is systematically associated to the level of Reg T margin requirements. Hardouvelis discovers evidence of a statistically important negative correlation between the level of margins and the volatility of monthly S&P 500 stock returns. Hardouvelis explains this correlation in a causal way and determines that Reg T margin requirements can be used to extend stock price volatility. Contradictory to the present literature, not only does Hardouvelis find a statistically important negative margin-volatility relationship he maintains that changes in margin can bring about substantial changes in monthly stock return volatility. According to Hardouvelis, a 10 percentage point increase in Reg T margin requirement, on average, will result in a 8% decrease in stock return volatility in the following month and bigger reductions in the long run. In an extended study, Hardouvelis affirms his 1988 findings using a different measure of monthly stock return volatility.

Succeeding the original Hardouvelis study and his extended analysis, a group of studies re-examined the margin-volatility issue. Ferris and Chance, Schwert, Salinger, Kupiec, and Hsieh and Miller all empirically examined the hypothesis that Reg T margin

requirements and stock price volatility are inversely related. Using dissimilar economic techniques to estimate time series aggregate stock return data, without exception, theses studies find no support for an inverse margin-volatility relationship. The outcome of results of these studies is that increases in volatility seem to precede increases in margin requirements. Increases in margin requirements seem to reduce the volume of margin credit extended, but there is no evidence to recommend that the level of margin requirements and stock return volatility are systematically related.

Hsieh and Miller indicate that the moving average constructions employed by Hardouvelis brings about a deceptive correlation between his measures of margin requirements and volatility. If one accurately accounts for this correlation, Hsieh and Miller show that there is no statistically significant margin-volatility relationship. Furthermore, corresponding to the pyramiding-depyramiding hypothesis, if margins are to have an effect, they must do so by changing the level of margin credit. Consequently, margin credit should not be recorded as an explanatory variable in Hardouvelis's expanded regression if it is attempting to measure volatility-magnifying effects of leverage. If margin credit is noted, the volatility regression measures the effect of margin requirements on volatility, keeping consistent the level of margin credit. According to the pyramiding-depyramiding hypothesis, there should be no margin effect if margin credit is established; and so the extended Hardouvelis model is misapprehended if it is trying to measure the effect of margin requirements on stock price volatility according to Miller. When Hsieh and Miller adjust the Hardouvelis analysis for these problems, they find no evidence of the claimed margin-volatility relationship.

In Hardouvelis's study, monthly stock return volatility is tested as a multiple of the absolute value of the residuals produced from a regression of monthly returns lagging 12-month returns and 12 monthly dummy variables. Hardouvelis declares that this volatility modification invalidate the integrity of the original Schwert volatility estimator. Instead of restricted correspondence with more traditional measures of volatility, Hsieh and Miller reveal that Hardouvelis's measure produces volatility calculations with remarkably unattractive sample properties, including a "preponderance of extreme volatility estimates in the sample period." Hsieh and Miller determine that this volatility measure is unsatisfactory for analysis.

The conclusions of studies that directly revisit Hardouvelis's analysis are expanded by studies that investigate the margin-volatility hypothesis using different experimental studies that explore the margin-volatility hypothesis using distinct experimental designs. Grube, Joy, and Howe explore the abnormal return effects produced when non-marginable OTC securities obtain margin eligibility status. They discover that these OTC stocks encounter a statistically significant abnormal positive price appreciation when they are recorded in the FRB's margin eligibility list and insignificant price effect if they are consequently eliminated from the list of marginable securities. When an OTC security is not marginable, investors must obtain the stock certificate and use it as collateral to secure credit. This undoubtedly is costly. Once marginable, the security can be left in street name at the broker and recorded as collateral in a margin account. Grube, Joy, and Howe consider that a subsequent delisting may not have an effect owing to a grandfather clause in Reg T that forbids new loans but permits

existing lending arrangements to continue. They translate their findings as consistent with a Fed endorsement effect or a convenience effect.

Seguin also studies the effects created when a sample of formerly non-marginable OTC stocks gain margin eligibility. In opposition to Grube and colleagues, Seguin studies the events' effect on volatilities, trading volumes, returns, and return autocorrelations. Seguin uncovers that, on average, margin eligibility is correlated with a 2% decrease in stock volatility, about a 2% increase in average share value, and about a 30% increase in trading volume where all the aforementioned effects are statistically important.

Seguin and Jarrell explore the pyramiding-depyramiding hypothesis by examining the relative return and volume conduct of marginable and non-marginable stocks during the October 1987 stock market crash. They discuss that, since margin credit was at a historical high during October 1987 and there is information that the crash accelerated substantial margin call activity, if depyramiding price constrains exist, they should be especially apparent in the return profiles of marginable stocks during the crash period. Seguin and Jarrell discover that, during the crash, marginable securities accomplished higher excess volumes relative to non-marginable securities, about 14 to 40%, as anticipated by margin-call depyramiding hypothesis. In spite of greater excess trading volumes, Seguin and Jarrell notice that the price declines recorded by marginable securities were less extreme than those recorded by non-marginable securities.

Apart from the questioned claims of Hardouvelis studies, the conclusions of the balance of studies that investigate the effects of Reg T margin requirements propose that, while margin requirements can have effects on the level of margin credit and equity

trading volumes, no immediate evidence supports the proposition that Reg T margin requirements can be used to restrain stock return volatility.

IV.

In the late 1980's, the margin volatility controversy advanced from Reg T margin requirements to the margin requirements on stock index futures products. Margin requirements in futures markets assist as a performance bond guarantee. In futures markets, margins are intended to preserve the futures clearinghouse from the risk produced from a single-days potential loss in contracts value. Owing to the institutional differences in futures-style trading and settlement, the margin needed to control a clearinghouse's one-day risk exposure on a futures contract is far smaller than the 50% initial margin requirement that has been set by the FRB to "protect" lenders in security transactions according to Ferris.

The distinction in required margin between futures and cash transactions causes a leverage advantage for stock index futures products. Likewise, the leverage available using individual stock options dominate that available in the cash market. Furthermore, individual stock options and stock index futures permit traders to circle the short selling rules that prevail in the cash market. If the leverage is the source of "excess" volatility in the stock markets, the beginning of stock options and stock index futures trading should have had sizeable effects on the volatility in the stock market.

Even though it is distinct that stock index futures products and options transactions have an important transactions cost and leverage advantage over direct cash market purchases or sales, it is a disputable question whether or not this leverage benefit is of any consequence for the volatility of returns in the underlying stock market. This controversy has at least two distinguishable aspects: Does the introduction of a

derivatives market influence the return volatility of the underlying instrument, and supplied with the existence of the derivative product, does a change in its margin requirement affect the price volatility of the underlying instrument? The succeeding sections will review the scientific information that relates to these logically distinguishable issues.

V.

Theoretical Models can be assembled to explore the effects of introducing a derivative market on the volatility in the underlying cash market. Turnovsky and Campbell unfolded an equilibrium model planned to assess the volatility and welfare implications connected with the introduction of a futures market. Because their model is highly nonlinear, they can only simulate equilibrium. They find that, in essentially all model arrangements, the introduction of a futures market either stabilizes cash market prices or has no effect on volatility. Weller and Yano also examine this question in a two-good, two-agent model with exogenous stochastic output. They discover that the introduction of a futures market has two effects: a price arbitrage effect and wealth transfer effect. "The price arbitrage effect unambiguously reduces price volatility in the cash market, but the volatility effects engendered by the wealth transfers that result from futures market trading are ambiguous as they depend on the heterogeneity in the trading populations' utility functions," says Weller.

Detemple and Selden model the effects of introducing a call option contract into an unfinished market setting, where assets comprise of only a stock and risk-free bond. They reveal that the price and return volatility of the stock in general will be influenced by the introduction of the derivative security. For a given set of endowments, when a derivative is introduced into an incomplete market setting with sufficiently diverse agents, the derivative agreement will be traded. Derivative trading will simplify a reallocation of consumption, which will be mirrored by a change in the equilibrium price

and return characteristics of the underlying security. In a distinct quadratic utility example, Detemple and Selden explain that the introduction of the derivative will expand the price of the security and decrease its return volatility.

Stein discovered a "theoretical model in which the introduction of a futures market can destabilize cash market prices." In the Stein model, the presence or absence of a futures market does not influence speculators by altering their constraint. Rather, misguided speculators are unable to trade in the spot market by assumption. When a futures market is introduced, speculators can trade and their trading may affect the data content of spot market prices. In this setting, Stein forms the theoretical possibility that the "noise" in speculators' information sets can cause spot market price volatility that cannot be distinguished from the underlying "fundamental" volatility by the other traders in this model. The beginning of a futures market allows the imperfectly educated speculators to trade, and their trading deceives the information content of market clearing spot prices. Because spot traders are risk averse and cannot distinguish between price shocks that owe to fundamental supply disturbances and those affected by the demands of imperfectly educated speculators, their inventory holdings are less responsive to price shocks when imperfectly informed speculators are permitted to trade in the futures market. The change in spot traders' inventory assets leads to additional spot price volatility and reduce social welfare.

Stein translates his model as a formal counterexample to the speculation that the addition of speculators to an existing market will add to the depth and liquidity of the market and thereby decrease the price effects produced by temporary shocks to demand or supply. Although agents voluntarily trade with the new futures market speculators,

they may be made worse off. Stein's results are a distinct example of Hart's general finding that, when markets are imperfect, opening another market may make agents worse off if markets stay incomplete. In both the Hart and Stein models, it is important that leverage does not play a role in creating the destabilizing price speculation or the loss in social welfare.

VI.

Edwards discusses the manner of cash market volatility in samples surrounding the introductions of four financial futures contracts: S&P 500, Value Line, 9-Day Eurodollars, and 90-Day T-Bill future contracts. Edwards tested volatility before and after the introduction of each financial futures contract, aside from data during the 1979-1982 period when the Federal Reserve adjusted its operating procedures. Succeeding the beginning of financial futures contracts trading, except for stock in 1987, volatility was lower in all cash markets in all years after the introduction of financial futures contract. Even though he does distinguish the expiration-day volatility effects on S&P 500 stock index transitory, Edwards determines that, on balance, the statistical evidence strongly suggests that cash market volatility has been lower following the introduction of the financial futures contracts examined in his study.

The Edwards study is just one study in a somewhat large literature that explores the affects of the introduction of S&P 500 stock index future contract trading on the underlying return volatilities of the stocks in the composite index. Apart from any shift in volatility that may owe to improved leverage opportunities reduced by the factors may alter the returns volatility of the stocks in the futures contract index, such as a change in the frequency with which stocks trade. Additional factors that may effect returns volatility are changes in individual stocks' bid-ask spreads that may owe to the introduction of stock index futures trading and changes in transactions cost of trading on macro-financial information.

Revisions in stock values may be connected to changes in economy wide factors that firms' values and changes in value that owe to distinctive firm developments. Although true underlying stock prices may change continuously as economy wide and firm specific news is dispersed, new share valuations are observed only infrequently when a trade occurs. If investors employ new information efficiently, true underlying stock price changes will be uncorrelated. As true underlying stock price changes are not observed instantaneously, occasional trading will cause the returns on a stock index, assembled from observed trade prices to be positively autocorelated and less volatile than the return on the true stock index value.

The beginning of stock index futures contract can have considerable effects on the volatility of the measured stock index, even if it has no effect on the volatility of the underlying true value of the index. Stock index futures prices and the true underlying prices of individual stocks in a stock index contract are strongly related through an absence of arbitrage cost of carry condition:

$$F_t = S_t e^{(r-d)(T-t)} \qquad (1)$$

Where Ft is the futures price at time t, St is the true value of the stock index at time t, r is the cost of carry rate of interest, d is the continuous dividend yield on the stock index, and T is the contract maturity date. Should equation (1) fail to hold, an arbitrage profit can be made created by taking appropriate positions in the stock index futures and the underlying stocks in the index. If r and d are roughly constant over short time intervals, equation (1) implies that the volatility of rate of return on the true value of the stock index and the volatility of the return on the index futures contract are equal. Owing to transactions costs, equation (1) will not hold exactly; when St is returned by the measured

index value, the volatility of the returns to the futures contract will surpass the volatility of the returns to the measured stock index, owing to the affects of occasional trading.

Lacking an index futures contract, individual shares trade with a frequency that can for present functions be taken as exogenous. The opening of a stock index futures contract may intensify the average frequency of trading in individual stocks because, when index arbitrage becomes profitable, investors must trade all shares in the index to profit from the arbitrage. Index arbitrage trades that communicate no new information will have no effect on the true underlying share price or return volatility and yet the intensified frequency of trading will enhance the volatility and reduce the autocorrelation of measured stock index returns. On the other hand, if the introduction of index futures contract trading reduces the transactions costs of trading on new macro-economic information, macro information will be reflected more quickly in index futures prices, and these price changes will be transferred through index arbitrage movement to the cash market, where they will be considered as an increase in individual stock return volatility. Again, such an escalation in volatility is unrelated to leverage.

Harris explores the hypothesis that the beginning of S&P 500 index futures contract enhances the volatility of the underlying instruments. Harris uses a regression model to explain the yearly return variance characteristics for stocks included in the S&P 500 index and the yearly return variance for a sample of similar non-index stocks. Harris examines volatility distinctions for each year between 1975-1987. In previous index futures trading, Harris discovers no statistically noteworthy distinction in return volatility after controlling each stocks beta, size, price level, and a measure of trade frequency. Following the introduction of index futures, Harris discovers that short-horizon returns of

S&P 500 stocks are more volatile when evaluated to comparable non-S&P 500 stocks. The common distinctions in S&P 500 daily stock return volatility during the futures trading period are very small between .03 and .14%, and likely unimportant economically when measure up to an average daily return standard deviation of about 2% in his sample. Even though the predictable daily distinctions are small, post-index futures daily return volatility differences, however, are statistically different from zero in 1985, 1986, and 1987.

Jagadeesh and Subrahmanyam supply some results that may in part clarify the Harris "excess volatility" findings as a result of competitive market making behavior and speculative excess. Jegadeesh and Subrahnymam test a hypothesis produced by Subrahmanyam and Gorton and Penacchi. The hypothesis suggests that, "because the adverse selection charges implicit in the average bid-ask spreads of individual stocks are likely to be much larger than the adverse selection component of a stock index future market maker's quote, uninformed traders face incentives to redirect their trades from individual stocks to the index futures contract." The movement of uninformed traders increases the proportion of informed traders faced by market makers for individual stocks, and individual share bid-ask spreads are forecasted to broaden consequently.

To examine the uniformed trader migration hypothesis, Jegadeesh and Subrahmanyam observe "mouth to end" bid-ask spreads for a sample of firms included in the S&P 500 index and a arbitrary sample of non-index firms generally comparable size in a period that encompasses the introduction of S&P 500 index futures trading. After controlling for the common bid-ask spread explanatory variables, they discover that the average proportional spreads increased subsequent to the introduction of index future

trading. Furthermore, they find that bid-ask spreads increased considerably more for S&P 500 stocks, but the increase in the magnitudes of implied trading cost is not economically important. These changes in bid-ask spreads could imply a greater bid-ask spread component in daily stock return volatility estimates.

Hong and Subrahmanyam used intra-day data to assess the impact that may have been conveyed by the introduction of the Major Market Index (MMI) index futures contract on the bid-ask spreads and volatilities of the individual stocks in the MMI index. Even though the MMI was established after the S&P 500, and all the MMI stocks are included in the S&P 500 index, no intra-day data is obtainable to study the effects of the S&P 500 futures contract introduction said Hong. When exploring intra-day volatility, Hong and Subrahmanyam removed the effects of bid ask spread and discovered no evidence that the introduction of MMI futures trading distorted intra-day volatility in the sample period.

Kamara, Miller, and Siegel examine the results of the S&P 500 index futures market trading on the return distribution of the S&P 500 index. "Using univariate nonparametric tests to correct for the abnormality in the underlying return distribution, in contrast to Edwards, they find that daily return distributions exhibit higher volatility in the post-index futures sample period," said Kupiec. Similar to Harris, they discover that longer-horizon return volatility is unchanged by the introduction of the stock index futures trading. Even though the measured distinctions in daily return volatility, the authors conclude that the observed changes in volatility do not owe to the introduction of the stock index futures contract. Rather, they demonstrate that, if the pre- and post index futures sample periods are arbitrarily split, the data show statistically important evidence

of shifting daily return variances. They come to the conclusion that daily return variances are non-stationary and the non-stationarity is irrelevant to the introduction of stock index futures trading.

Kamara and colleagues also study the number of outlier returns in the pre- and post index futures trading period. They cannot discard the hypothesis that there are more outliers in the sample period with index futures trading. Certainly the data shows that positive return outliers are far more prevalent when index futures are trading. If October 1987 is excluded from the sample however, outliers are just as likely with or without index futures. In a "multivariate analysis" proposed to monitor for macro-economic sources of variation in the S&P 500 returns, Kamara and colleagues research whether the regression's residual volatility changes between the pre- and post-index futures trading samples. If October 1987 is excluded from the sample, the post-index futures residual volatility is considerably smaller than the residual volatility before S&P 500 stock index futures were introduced. Including October 1987, the post-index futures residual variance is roughly twice as large as the pre-index futures sample residual variance. They come to the conclusion that, unless one believes that the futures markets caused the 1987 crash, futures markets do not appear to have increased the S&P 500's "excess volatility."

Bessembinder and Seguin research the correlation between the cash volatility of the S&P 500 index, trading volume in both cash and futures markets, and open interest in the future market over the sample period January 1978 to September 1989. They decompose cash and futures markets volumes into three components that "correspond with the long-term trend, a transitory expected component, and an unexpected

component." Bessembinder and Seguin discover that the unexpected component of cash trading volume is positively associated to volatility in the spot market, and the beginning of futures contracts trading attenuates this volatility-volume relationship. They also discover that the volatility in the cash market is also is negatively related to the expected component of futures trading volume. Therefore, unlike the well-known positive volume-volatility relationship apparent in the cash market, increases in the expected component of futures trading volume are connected with lower, not higher, cash market volatility. As in the cash market, they discover that the unanticipated futures trading volume is positively related to cash market volatility. Bessembinder and Seguin suggest that their results are consistent with the hypothesis that futures markets improve the liquidity and the depth of markets. They find no indication that supports the hypothesis that futures markets are "a conduit for destabilizing speculation."

While the empirical evidence relating to the introduction of equity index futures contracts recommends that derivative market introductions, on average have had a stabilizing influence on the stock return volatility. Some evidence implies that the existence of derivative products may have exacerbated transitory spikes in volatility. For instance, Stoll and Whaley discovered that the introduction of stock index futures led to substantially higher cash market volatility on index futures expiration days, and certainly recognition of these effects led to modifications in contract expiration procedures that seem to have attenuated expiration day volatility effects. Another potential of derivative-related transitory volatility is the behavior of S&P 500 stock returns during the October 1987 crash. Even though it is unclear whether the underlying order disparities owe to the existence of the S&P 500 index in futures contract, Blume, MacKinlay and Tecker

uncover evidence that, during the 1987 crash period, stocks included in the S&P 500 index experienced larger transitory increase in non S&P 500 stocks.

VII.

After studying the academic evidence that investigates the relationship between margin and volatility in both cash and futures markets and believing the results of studies that measure the effects of derivative market introductions, this study comes to the conclusion that no considerable body of evidence supports the hypothesis that margin requirements can be systematically distorted to manage the volatility in stock markets. The empirical evidence demonstrates that, while Reg T margin requirements may lower the volume of securities credit lending and high futures margins do appear to reduce the open interest in futures contracts, neither of these measurable effects appears to be systematically associated with lower stock return volatility. The evidence to date suggests that, contrary to the leverage arguments believed by the pyramiding-depyramiding hypothesis and explicitly accepted by many of the official studies of the 1987 stock market crash, no scientific evidence supports the hypothesis that tightening leverage constraints in either the cash or derivative markets will reduce stock return volatility.

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